

SEQUENCE LISTING

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<120> METHODS AND COMPOSITIONS FOR PRODUCTION OF FLAVONOID
AND ISOFLAVONOID NUTRACEUTICALS

<130> NBLE:007US

<140> UNKNOWN
<141> 2003-09-10

<150> 60/409,447
<151> 2002-09-10

<160> 14

<170> PatentIn Ver. 2.1

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<212> DNA
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1824

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Pro Asn Pro Pro Ser Pro Lys Pro Arg Leu Pro Phe Ile Gly His Leu
35 40 45

His Leu Leu Lys Asp Lys Leu Leu His Tyr Ala Leu Ile Asp Leu Ser
50 55 60

Lys Lys His Gly Pro Leu Phe Ser Leu Tyr Phe Gly Ser Met Pro Thr
65 70 75 80

Val Val Ala Ser Thr Pro Glu Leu Phe Lys Leu Phe Leu Gln Thr His
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Glu Ala Thr Ser Phe Asn Thr Arg Phe Gln Thr Ser Ala Ile Arg Arg
100 105 110

Leu Thr Tyr Asp Ser Ser Val Ala Met Val Pro Phe Gly Pro Tyr Trp
115 120 125

Lys Phe Val Arg Lys Leu Ile Met Asn Asp Leu Pro Asn Ala Thr Thr
130 135 140

Val Asn Lys Leu Arg Pro Leu Arg Thr Gln Gln Thr Arg Lys Phe Leu
145 150 155 160

Arg Val Met Ala Gln Gly Ala Glu Ala Gln Lys Pro Leu Asp Leu Thr
165 170 175

Glu Glu Leu Leu Lys Trp Thr Asn Ser Thr Ile Ser Met Met Leu
180 185 190

Gly Glu Ala Glu Glu Ile Arg Asp Ile Ala Arg Glu Val Leu Lys Ile
195 200 205

Phe Gly Glu Tyr Ser Leu Thr Asp Phe Ile Trp Pro Leu Lys His Leu
210 215 220

Lys Val Gly Lys Tyr Glu Lys Arg Ile Asp Asp Ile Leu Asn Lys Phe
225 230 235 240

Asp Pro Val Val Glu Arg Val Ile Lys Lys Arg Arg Glu Ile Val Arg
245 250 255

Arg Arg Lys Asn Gly Glu Val Val Glu Gly Glu Val Ser Gly Val Phe
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 275 280 285
 Ile Thr Lys Asp His Ile Glu Gly Leu Val Val Asp Phe Phe Ser Ala
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 Gly Thr Asp Ser Thr Ala Val Ala Thr Glu Trp Ala Leu Ala Glu Leu
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 Ile Asn Asn Pro Lys Val Leu Glu Lys Ala Arg Glu Glu Val Tyr Ser
 325 330 335
 Val Val Gly Lys Asp Arg Leu Val Asp Glu Val Asp Thr Gln Asn Leu
 340 345 350
 Pro Tyr Ile Arg Ala Ile Val Lys Glu Thr Phe Arg Met His Pro Pro
 355 360 365
 Leu Pro Val Val Lys Arg Lys Cys Thr Glu Glu Cys Glu Ile Asn Gly
 370 375 380
 Tyr Val Ile Pro Glu Gly Ala Leu Ile Leu Phe Asn Val Trp Gln Val
 385 390 395 400
 Gly Arg Asp Pro Lys Tyr Trp Asp Arg Pro Ser Glu Phe Arg Pro Glu
 405 410 415
 Arg Phe Leu Glu Thr Gly Ala Glu Gly Glu Ala Gly Pro Leu Asp Leu
 420 425 430
 Arg Gly Gln His Phe Gln Leu Leu Pro Phe Gly Ser Gly Arg Arg Met
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 Cys Pro Gly Val Asn Leu Ala Thr Ser Gly Met Ala Thr Leu Leu Ala
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 Ser Leu Ile Gln Cys Phe Asp Leu Gln Val Leu Gly Pro Gln Gly Gln
 465 470 475 480
 Ile Leu Lys Gly Gly Asp Ala Lys Val Ser Met Glu Glu Arg Ala Gly
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 <213> Medicago sativa

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 Thr Ala Ile Thr Val Glu Asn Leu Glu Tyr Pro Ala Val Val Thr Ser
 10 15 20

ccg gtc acc ggc aaa tca tat ttc ctc ggt ggc gct ggg gag aga gga 151
 Pro Val Thr Gly Lys Ser Tyr Phe Leu Gly Gly Ala Gly Glu Arg Gly
 25 30 35

ttg acc att gaa gga aac ttc atc aag ttc act gcc ata ggt gtt tat 199
 Leu Thr Ile Glu Gly Asn Phe Ile Lys Phe Thr Ala Ile Gly Val Tyr
 40 45 50

ttg gaa gat ata gca gtg gct tca cta gct gcc aaa tgg aag ggt aaa 247
 Leu Glu Asp Ile Ala Val Ala Ser Leu Ala Ala Lys Trp Lys Gly Lys
 55 60 65

tca tct gaa gag tta ctt gag acc ctt gac ttt tac aga gac atc atc 295
 Ser Ser Glu Glu Leu Leu Glu Thr Leu Asp Phe Tyr Arg Asp Ile Ile
 70 75 80 85

tca ggt ccc ttt gaa aag tta att aga ggg tca aag att agg gaa ttg 343
 Ser Gly Pro Phe Glu Lys Leu Ile Arg Gly Ser Lys Ile Arg Glu Leu
 90 95 100

agt ggt cct gag tac tca agg aag gtt atg gag aac tgt gtg gca cac 391
 Ser Gly Pro Glu Tyr Ser Arg Lys Val Met Glu Asn Cys Val Ala His
 105 110 115

ttg aaa tca gtt gga act tat gga gat gca gaa gct gaa gct atg caa 439
 Leu Lys Ser Val Gly Thr Tyr Gly Asp Ala Glu Ala Met Gln
 120 125 130

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 Lys Phe Ala Glu Ala Phe Lys Pro Val Asn Phe Pro Pro Gly Ala Ser
 135 140 145

gtt ttc tac agg caa tca cct gat gga ata tta ggg ctt agt ttc tct 535
 Val Phe Tyr Arg Gln Ser Pro Asp Gly Ile Leu Glu Leu Ser Phe Ser
 150 155 160 165

ccg gat aca agt ata cca gaa aag gag gct gca ctc ata gag aac aag 583
 Pro Asp Thr Ser Ile Pro Glu Lys Glu Ala Ala Leu Ile Glu Asn Lys
 170 175 180

gca gtt tca tca gca gtg ttg gag act atg atc ggc gag cac gct gtt 631
 Ala Val Ser Ser Ala Val Leu Glu Thr Met Ile Gly Glu His Ala Val
 185 190 195

tcc cct gat ctt aag cgc tgt tta gct gca aga tta cct gcg ttg ttg 679
Ser Pro Asp Leu Lys Arg Cys Leu Ala Ala Arg Leu Pro Ala Leu Leu
200 205 210

aac gag ggt gct ttc aag att gga aac tga tgatgattat actcctatat 729
Asn Glu Gly Ala Phe Lys Ile Gly Asn
215 220

cactgcattt ccaaaagcgt tgcagcacaa gaatgagacc atgaactttt ttaagtctac 789
acgtttaatt ttttgtatctatcttacct tcttattagt atcaataata tgaaatgaaa 849
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Ala Gly Glu Arg Gly Leu Thr Ile Glu Gly Asn Phe Ile Lys Phe Thr
35 40 45
Ala Ile Gly Val Tyr Leu Glu Asp Ile Ala Val Ala Ser Leu Ala Ala
50 55 60
Lys Trp Lys Gly Lys Ser Ser Glu Glu Leu Leu Glu Thr Leu Asp Phe
65 70 75 80
Tyr Arg Asp Ile Ile Ser Gly Pro Phe Glu Lys Leu Ile Arg Gly Ser
85 90 95
Lys Ile Arg Glu Leu Ser Gly Pro Glu Tyr Ser Arg Lys Val Met Glu
100 105 110
Asn Cys Val Ala His Leu Lys Ser Val Gly Thr Tyr Gly Asp Ala Glu
115 120 125
Ala Glu Ala Met Gln Lys Phe Ala Glu Ala Phe Lys Pro Val Asn Phe
130 135 140
Pro Pro Gly Ala Ser Val Phe Tyr Arg Gln Ser Pro Asp Gly Ile Leu
145 150 155 160
Gly Leu Ser Phe Ser Pro Asp Thr Ser Ile Pro Glu Lys Glu Ala Ala
165 170 175
Leu Ile Glu Asn Lys Ala Val Ser Ser Ala Val Leu Glu Thr Met Ile
180 185 190
Gly Glu His Ala Val Ser Pro Asp Leu Lys Arg Cys Leu Ala Ala Arg
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210 215 220

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<213> *Medicago sativa*

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ctcaggtccc tttaaaaagt taatttagagg gtcaaagatt agggattga gtggcctgaa 240
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Met Val Ser Val Ser Glu Ile Arg Lys Ala Gln Arg Ala Glu
1 5 10

ggt cct gca acc att ttg gcc att ggc act gca aat cca gca aat tgt 156
Gly Pro Ala Thr Ile Leu Ala Ile Gly Thr Ala Asn Pro Ala Asn Cys
15 20 25 30

gtt gaa caa agt aca tat cct gat ttt tac ttt aaa atc aca aat agc 204
Val Glu Gln Ser Thr Tyr Pro Asp Phe Tyr Phe Lys Ile Thr Asn Ser
35 40 45

gag cac aag act gaa ctc aaa gag aaa ttc caa cgc atg tgt gat aaa 252
Glu His Lys Thr Glu Leu Lys Glu Lys Phe Gln Arg Met Cys Asp Lys
50 55 60

tct atg atc aag agg aga tac atg tac cta aca gag gag att ttg aaa 300
Ser Met Ile Lys Arg Arg Tyr Met Tyr Leu Thr Glu Ile Leu Lys
65 70 75

gag aat cct agt gtt tgt gaa tat atg gca cct tca ttg gat gcc agg 348
Glu Asn Pro Ser Val Cys Glu Tyr Met Ala Pro Ser Leu Asp Ala Arg
80 85 90

caa gac atg gtg gtg gta gag gta cct aga cta ggg aag gag gct gca 396
Gln Asp Met Val Val Val Glu Val Pro Arg Leu Gly Lys Glu Ala Ala

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gtg aag gct ata aaa gaa tgg ggt caa cca aag tca aag att act cac Val Lys Ala Ile Lys Glu Trp Gly Gln Pro Lys Ser Lys Ile Thr His				444
115	120	125		
tta att gtt tgc act aca agt ggt gta gac atg cct gga gct gat tac Leu Ile Val Cys Thr Ser Gly Val Asp Met Pro Gly Ala Asp Tyr				492
130	135	140		
caa ctc aca aaa ctc ttg ggt ctt cgc cca tat gtg aaa agg tat atg Gln Leu Thr Lys Leu Leu Gly Leu Arg Pro Tyr Val Lys Arg Tyr Met				540
145	150	155		
atg tac caa caa ggt tgc ttt gca gga ggc acg gtg ctt cgt ttg gct Met Tyr Gln Gln Gly Cys Phe Ala Gly Thr Val Leu Arg Leu Ala				588
160	165	170		
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175	180	185	190	
tct gaa gtc act gca gtc aca ttc cgc ggc cct agt gat act cac ttg Ser Glu Val Thr Ala Val Thr Phe Arg Gly Pro Ser Asp Thr His Leu				684
195	200	205		
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225	230	235		
atg gtt tgg act gca caa aca att gct cca gat agt gaa gga gcc att Met Val Trp Thr Ala Gln Thr Ile Ala Pro Asp Ser Glu Gly Ala Ile				828
240	245	250		
gat ggt cac ctt cgt gaa gct gga cta aca ttc cac ctt ctt aaa gat Asp Gly His Leu Arg Glu Ala Gly Leu Thr Phe His Leu Leu Lys Asp				876
255	260	265	270	
gtt cct ggg att gtt tca aag aac att gat aaa gca tta gtt gaa gct Val Pro Gly Ile Val Ser Lys Asn Ile Asp Lys Ala Leu Val Glu Ala				924
275	280	285		
ttc caa cca ttg gga att tct gat tac aac tca atc ttt tgg att gca Phe Gln Pro Leu Gly Ile Ser Asp Tyr Asn Ser Ile Phe Trp Ile Ala				972
290	295	300		
cac cct ggt ggc cct gca att tta gat caa gta gag caa aag tta gcc His Pro Gly Gly Pro Ala Ile Leu Asp Gln Val Glu Gln Lys Leu Ala				1020
305	310	315		
ttg aag cct gaa aag atg aga gcc act aga gaa gtg ctt agt gaa tat Leu Lys Pro Glu Lys Met Arg Ala Thr Arg Glu Val Leu Ser Glu Tyr				1068
320	325	330		

gga aat atg tca agt gca tgt gtt ttg ttt atc tta gat gaa atg aga 1116
Gly Asn Met Ser Ser Ala Cys Val Leu Phe Ile Leu Asp Glu Met Arg
335 340 345 350

aag aaa tca actcaa gat gga ctg aag aca aca gga gaa gga ctt gaa 1164
Lys Lys Ser Thr Gln Asp Gly Leu Lys Thr Thr Gly Glu Gly Leu Glu
355 360 365

tgg ggt gtg tta ttt ggc ttt gga cca gga ctt acc ata gaa act gtt 1212
Trp Gly Val Leu Phe Gly Phe Gly Pro Gly Leu Thr Ile Glu Thr Val
370 375 380

gtt ttg cgc agt gtc gct ata tga aatgcttaat tattttat tatttatca 1266
Val Leu Arg Ser Val Ala Ile
385 390

ctttcaaatt tgcttgattt ttatgttaagg atgaaaaact cgtctacagt tcaacattta 1326
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35 40 45
Lys Thr Glu Leu Lys Glu Lys Phe Gln Arg Met Cys Asp Lys Ser Met
50 55 60
Ile Lys Arg Arg Tyr Met Tyr Leu Thr Glu Glu Ile Leu Lys Glu Asn
65 70 75 80
Pro Ser Val Cys Glu Tyr Met Ala Pro Ser Leu Asp Ala Arg Gln Asp
85 90 95
Met Val Val Val Glu Val Pro Arg Leu Gly Lys Glu Ala Ala Val Lys
100 105 110
Ala Ile Lys Glu Trp Gly Gln Pro Lys Ser Lys Ile Thr His Leu Ile
115 120 125
Val Cys Thr Thr Ser Gly Val Asp Met Pro Gly Ala Asp Tyr Gln Leu
130 135 140
Thr Lys Leu Leu Gly Leu Arg Pro Tyr Val Lys Arg Tyr Met Met Tyr
145 150 155 160
Gln Gln Gly Cys Phe Ala Gly Gly Thr Val Leu Arg Leu Ala Lys Asp
165 170 175
Leu Ala Glu Asn Asn Lys Gly Ala Arg Val Leu Val Val Cys Ser Glu
180 185 190
Val Thr Ala Val Thr Phe Arg Gly Pro Ser Asp Thr His Leu Asp Ser
195 200 205
Leu Val Gly Gln Ala Leu Phe Gly Asp Gly Ala Ala Ala Leu Ile Val
210 215 220
Gly Ser Asp Pro Val Pro Glu Ile Glu Lys Pro Ile Phe Glu Met Val

225	230	235	240
Trp Thr Ala Gln Thr Ile Ala Pro Asp Ser Glu Gly Ala Ile Asp Gly			
245	250	255	
His Leu Arg Glu Ala Gly Leu Thr Phe His Leu Leu Lys Asp Val Pro			
260	265	270	
Gly Ile Val Ser Lys Asn Ile Asp Lys Ala Leu Val Glu Ala Phe Gln			
275	280	285	
Pro Leu Gly Ile Ser Asp Tyr Asn Ser Ile Phe Trp Ile Ala His Pro			
290	295	300	
Gly Gly Pro Ala Ile Leu Asp Gln Val Glu Gln Lys Leu Ala Leu Lys			
305	310	315	320
Pro Glu Lys Met Arg Ala Thr Arg Glu Val Leu Ser Glu Tyr Gly Asn			
325	330	335	
Met Ser Ser Ala Cys Val Leu Phe Ile Leu Asp Glu Met Arg Lys Lys			
340	345	350	
Ser Thr Gln Asp Gly Leu Lys Thr Thr Gly Glu Gly Leu Glu Trp Gly			
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Met Val Ser Val			
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tct gaa att cgt cag gct caa agg gca gaa ggc cct gca acc atc atg	165		
Ser Glu Ile Arg Gln Ala Gln Arg Ala Glu Gly Pro Ala Thr Ile Met			
5 10 15	20		
gcc att ggc act gca aat cca tcc aac tgt gtt gaa caa agc aca tat	213		
Ala Ile Gly Thr Ala Asn Pro Ser Asn Cys Val Glu Gln Ser Thr Tyr			
25 30 35			
cct gat ttc tac ttc aaa atc aca aac agt gag cac aaa gtt gaa ctc	261		
Pro Asp Phe Tyr Phe Lys Ile Thr Asn Ser Glu His Lys Val Glu Leu			
40 45 50			
aaa gag aaa ttt caa cgc atg tgt gat aaa tcc atg atc aag agg aga	309		
Lys Glu Lys Phe Gln Arg Met Cys Asp Lys Ser Met Ile Lys Arg Arg			
55 60 65			
tac atg tat ctt acc gaa gag att ttg aaa gaa aat cca agt gta tgt	357		

Tyr	Met	Tyr	Leu	Thr	Glu	Glu	Ile	Leu	Lys	Glu	Asn	Pro	Ser	Val	Cys
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gaa tac atg gca cct tca ttg gat gct agg cag gac atg gtg gtg gta															405
Glu	Tyr	Met	Ala	Pro	Ser	Leu	Asp	Ala	Arg	Gln	Asp	Met	Val	Val	Val
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gag gta cct aga ctt gga aag gag gct gca gtg aag gct ata aaa gaa															453
Glu	Val	Pro	Arg	Leu	Gly	Lys	Glu	Ala	Ala	Val	Lys	Ala	Ile	Lys	Glu
105								110					115		
tgg ggc caa cca aaa tca aag att aca cac tta ata ttt tgt acc aca															501
Trp	Gly	Gln	Pro	Lys	Ser	Lys	Ile	Thr	His	Leu	Ile	Phe	Cys	Thr	Thr
120							125					130			
agt ggt gta gac atg cct ggt gcc gat tac caa ctc aca aaa ctc tta															549
Ser	Gly	Val	Asp	Met	Pro	Gly	Ala	Asp	Tyr	Gln	Leu	Thr	Lys	Leu	Leu
135							140					145			
ggc ctt cgt cca tat gtg aaa agg tat atg atg tac caa caa ggg tgc															597
Gly	Leu	Arg	Pro	Tyr	Val	Lys	Arg	Tyr	Met	Met	Tyr	Gln	Gln	Gly	Cys
150							155					160			
ttt gca ggt ggg acg gtc ctt cgt ttg gcc aag gac ttg gct gag aac															645
Phe	Ala	Gly	Gly	Thr	Val	Leu	Arg	Leu	Ala	Lys	Asp	Leu	Ala	Glu	Asn
165					170					175			180		
aat aaa ggt gct cgt gtg ttg gtt ttt ttt gaa gtt act gcg gtc															693
Asn	Lys	Gly	Ala	Arg	Val	Leu	Val	Val	Cys	Ser	Glu	Val	Thr	Ala	Val
185							190					195			
aca ttc cgt ggt cct agt gat act cat tta gac agt ctt gtt gga caa															741
Thr	Phe	Arg	Gly	Pro	Ser	Asp	Thr	His	Leu	Asp	Ser	Leu	Val	Gly	Gln
200							205					210			
gca ctc ttt gga gat ggt gct gca ctc att gtt ggt tct gac cca															789
Ala	Leu	Phe	Gly	Asp	Gly	Ala	Ala	Ala	Leu	Ile	Val	Gly	Ser	Asp	Pro
215							220					225			
ata cca gaa att gag aaa cct ata ttt gag atg gtt tgg act gca caa															837
Ile	Pro	Glu	Ile	Glu	Lys	Pro	Ile	Phe	Glu	Met	Val	Trp	Thr	Ala	Gln
230							235					240			
aca att gct cca gac agt gaa gga gcc att gat ggt cac ctt gtc gaa															885
Thr	Ile	Ala	Pro	Asp	Ser	Glu	Gly	Ala	Ile	Asp	Gly	His	Leu	Val	Glu
245							250					255			260
gct ggt cta aca ttt cac ctt aaa gat gtt cct ggg att gtt tca															933
Ala	Gly	Leu	Thr	Phe	His	Leu	Leu	Lys	Asp	Val	Pro	Gly	Ile	Val	Ser
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Ser	Asp	Tyr	Asn	Ser	Ile	Phe	Trp	Ile	Ala	His	Pro	Gly	Gly	Pro	Ala

295	300	305																																																																																																																																																																																																																																																																																																																																	
att cta gac caa gtt gaa gaa aag tta ggc tta aaa cct gaa aag atg Ile Leu Asp Gln Val Glu Glu Lys Leu Gly Leu Lys Pro Glu Lys Met 310	315	320	1077																																																																																																																																																																																																																																																																																																																																
aag gcc act agg gaa gta ctt agt gaa tat ggt aac atg tca agt gca Lys Ala Thr Arg Glu Val Leu Ser Glu Tyr Gly Asn Met Ser Ser Ala 325	330	335	1125																																																																																																																																																																																																																																																																																																																																
tgt gta ttg ttc atc tta gat gag atg aga aag aaa tcg gca caa gcg Cys Val Leu Phe Ile Leu Asp Glu Met Arg Lys Lys Ser Ala Gln Ala 345	350	355	1173																																																																																																																																																																																																																																																																																																																																
gga ctt aaa acc aca gga gaa ggc ctt gac tgg ggt gtg ttg ttt ggc Gly Leu Lys Thr Thr Gly Glu Gly Leu Asp Trp Gly Val Leu Phe Gly 360	365	370	1221																																																																																																																																																																																																																																																																																																																																
ttc gga cct gga ctt acc att gaa acc gtt gtt ctc cat agc gtg gct Phe Gly Pro Gly Leu Thr Ile Glu Thr Val Val Leu His Ser Val Ala 375	380	385	1269																																																																																																																																																																																																																																																																																																																																
ata tga aatgattgat tgtttattt tattgtatta cttaact tgcttgaat Ile 390			1325																																																																																																																																																																																																																																																																																																																																
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Met	Val	Ser	Val	Ser	Glu	Ile	Arg	Gln	Ala	Gln	Arg	Ala	Glu	Gly	Pro																																																																																																																																																																																																																																																																																																																				
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			85				90			95																																																																																																																																																																																																																																																																																																																									
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Ala	Ile	Lys	Glu	Trp	Gly	Gln	Pro	Lys	Ser	Lys	Ile	Thr	His	Leu	Ile																																																																																																																																																																																																																																																																																																																				
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Phe	Cys	Thr	Thr	Ser	Gly	Val	Asp	Met	Pro	Gly	Ala	Asp	Tyr	Gln	Leu																																																																																																																																																																																																																																																																																																																				
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Gln Gln Gly Cys Phe Ala Gly Gly Thr Val Leu Arg Leu Ala Lys Asp
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 Leu Ala Glu Asn Asn Lys Gly Ala Arg Val Leu Val Val Cys Ser Glu
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 Val Thr Ala Val Thr Phe Arg Gly Pro Ser Asp Thr His Leu Asp Ser
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 Leu Val Gly Gln Ala Leu Phe Gly Asp Gly Ala Ala Ala Leu Ile Val
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 Gly Ser Asp Pro Ile Pro Glu Ile Glu Lys Pro Ile Phe Glu Met Val
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 Trp Thr Ala Gln Thr Ile Ala Pro Asp Ser Glu Gly Ala Ile Asp Gly
 245 250 255
 His Leu Val Glu Ala Gly Leu Thr Phe His Leu Leu Lys Asp Val Pro
 260 265 270
 Gly Ile Val Ser Lys Asn Ile Asp Lys Ala Leu Ile Glu Ala Phe Gln
 275 280 285
 Pro Leu Asn Ile Ser Asp Tyr Asn Ser Ile Phe Trp Ile Ala His Pro
 290 295 300
 Gly Gly Pro Ala Ile Leu Asp Gln Val Glu Glu Lys Leu Gly Leu Lys
 305 310 315 320
 Pro Glu Lys Met Lys Ala Thr Arg Glu Val Leu Ser Glu Tyr Gly Asn
 325 330 335
 Met Ser Ser Ala Cys Val Leu Phe Ile Leu Asp Glu Met Arg Lys Lys
 340 345 350
 Ser Ala Gln Ala Gly Leu Lys Thr Thr Gly Glu Gly Leu Asp Trp Gly
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 gagatctgcc gtcagatcgt cgaggcttgc gagaattggg gatatccca agtgggttgc 180
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35 40 45

Ala Ser Pro Asp Arg Ala Ala Val Val Ser Ala Val Gly Asp Ala Cys
50 55 60

Arg Thr His Gly Phe Phe Gln Val Val Asn His Gly Ile Asp Ala Ala
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Leu Ile Ala Ser Val Met Glu Val Gly Arg Glu Phe Phe Arg Leu Pro
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Ala Glu Glu Lys Ala Lys Leu Tyr Ser Asp Asp Pro Ala Lys Lys Ile
100 105 110

Arg Leu Ser Thr Ser Phe Asn Val Arg Lys Glu Thr Val His Asn Trp
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Arg Asp Tyr Leu Arg Leu His Cys Tyr Pro Leu His Gln Phe Val Pro
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Asp Trp Pro Ser Asn Pro Pro Ser Phe Lys Glu Ile Ile Gly Thr Tyr
145 150 155 160

Cys Thr Glu Val Arg Glu Leu Gly Phe Arg Leu Tyr Glu Ala Ile Ser
165 170 175

Glu Ser Leu Gly Leu Glu Gly Gly Tyr Met Arg Glu Thr Leu Gly Glu
180 185 190

Gln Glu Gln His Met Ala Val Asn Tyr Tyr Pro Gln Cys Pro Glu Pro
195 200 205

Glu Leu Thr Tyr Gly Leu Pro Ala His Thr Asp Pro Asn Ala Leu Thr
210 215 220

Ile Leu Leu Met Asp Asp Gln Val Ala Gly Leu Gln Val Leu Asn Asp
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Gly Lys Trp Ile Ala Val Asn Pro Gln Pro Gly Ala Leu Val Ile Asn

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Ile Gly Asp Gln Leu Gln Ala Leu Ser Asn Gly Lys Tyr Arg Ser Val		
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Trp His Arg Ala Val Val Asn Ser Asp Arg Glu Arg Met Ser Val Ala		
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Ser Phe Leu Cys Pro Cys Asn Ser Val Glu Leu Gly Pro Ala Lys Lys		
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Leu Ile Thr Asp Asp Ser Pro Ala Val Tyr Arg Asn Tyr Thr Tyr Asp		
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Leu Glu Leu Phe Arg Thr		
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 aaggaagcat tgaccaaggg ttgcgtggat atggaccaaa aggttgtggtaaattactat 540
 caaaaatgtc cacagccaga cctcacattt gggctaaagc gccacacaga tcctggcacc 600
 atcactctgt tgttgcagga ccaggtgggt gggcttcagg ccaccaggaa tggcggcaag 660
 acctggatca ctgttcagcc tgttgaagga gctttcgtcg tcaatcttgg agaccatgg 720
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cag gtg gtc gat cat ggc gtc gat gcc agt cta atc tcc gac atg aca Gln Val Val Asp His Gly Val Asp Ala Ser Leu Ile Ser Asp Met Thr	50	55	60	192	
cgt ctt gcc cgt gac ttc ttc gcc atg cct ccc gag gaa aag ctt cgt Arg Leu Ala Arg Asp Phe Phe Ala Met Pro Pro Glu Glu Lys Leu Arg	65	70	75	240	
ttc gac atg tcc ggc ggc aag aag ggc ggt ttc att gtc tcc agc cat Phe Asp Met Ser Gly Gly Lys Lys Gly Gly Phe Ile Val Ser Ser His	85	90	95	288	
ctg caa gga gaa gca gtg caa gat tgg cgt gaa att gtg aca tat ttc Leu Gln Gly Glu Ala Val Gln Asp Trp Arg Glu Ile Val Thr Tyr Phe	100	105	110	336	
tca tac cca att agg acc aga gac tat tcg agg tgg ccg gac aag cca Ser Tyr Pro Ile Arg Thr Arg Asp Tyr Ser Arg Trp Pro Asp Lys Pro	115	120	125	384	
gaa ggg tgg aga aag gtg acg gag gag tac agt gac aaa ttg atg gga Glu Gly Trp Arg Lys Val Thr Glu Glu Tyr Ser Asp Lys Leu Met Gly	130	135	140	432	
ctg gca tgc aaa ctg ttg gaa gtg cta tcg gag gc ^g atg gga tta gag Leu Ala Cys Lys Leu Leu Glu Val Leu Ser Glu Ala Met Gly Leu Glu	145	150	155	160	480
aag gaa gca ttg acc aag gct tgc gtg gat atg gac caa aag gtt gtg Lys Glu Ala Leu Thr Lys Ala Cys Val Asp Met Asp Gln Lys Val Val	165	170	175	528	
gtt aat tac tat cca aaa tgt cca cag cca gac ctc aca ttg ggg cta Val Asn Tyr Tyr Pro Lys Cys Pro Gln Pro Asp Leu Thr Leu Gly Leu	180	185	190	576	
aag cgc cac aca gat cct ggc acc atc act ctg ttg ttg cag gac cag Lys Arg His Thr Asp Pro Gly Thr Ile Thr Leu Leu Gln Asp Gln	195	200	205	624	
gtg ggt ggg ctt cag gcc acc agg gat ggc ggc aag acc tgg atc act Val Gly Gly Leu Gln Ala Thr Arg Asp Gly Gly Lys Thr Trp Ile Thr	210	215	220	672	
gtt cag cct gtt gaa gga gct ttc gtc gtc aat ctt gga gac cat ggt Val Gln Pro Val Glu Gly Ala Phe Val Val Asn Leu Gly Asp His Gly	225	230	235	240	720
cat ttt ctg agt aac ggg agg ttc aag aac gct gat cac caa gca gtg				768	

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 <211> 271
 <212> PRT
 <213> Juglans nigra

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 Pro Ile Ile Ser Leu Ala Gly Ile Asp Glu Val His Gly Arg Arg Thr
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 Glu Ile Cys Gln Lys Ile Val Glu Ala Cys Glu Asp Trp Gly Ile Phe
 35 40 45

 Gln Val Val Asp His Gly Val Asp Ala Ser Leu Ile Ser Asp Met Thr
 50 55 60

 Arg Leu Ala Arg Asp Phe Phe Ala Met Pro Pro Glu Glu Lys Leu Arg
 65 70 75 80

 Phe Asp Met Ser Gly Gly Lys Gly Gly Phe Ile Val Ser Ser His
 85 90 95

 Leu Gln Gly Glu Ala Val Gln Asp Trp Arg Glu Ile Val Thr Tyr Phe
 100 105 110

 Ser Tyr Pro Ile Arg Thr Arg Asp Tyr Ser Arg Trp Pro Asp Lys Pro
 115 120 125

 Glu Gly Trp Arg Lys Val Thr Glu Glu Tyr Ser Asp Lys Leu Met Gly
 130 135 140

 Leu Ala Cys Lys Leu Leu Glu Val Leu Ser Glu Ala Met Gly Leu Glu
 145 150 155 160

 Lys Glu Ala Leu Thr Lys Ala Cys Val Asp Met Asp Gln Lys Val Val
 165 170 175

 Val Asn Tyr Tyr Pro Lys Cys Pro Gln Pro Asp Leu Thr Leu Gly Leu
 180 185 190

 Lys Arg His Thr Asp Pro Gly Thr Ile Thr Leu Leu Leu Gln Asp Gln
 195 200 205

 Val Gly Gly Leu Gln Ala Thr Arg Asp Gly Gly Lys Thr Trp Ile Thr
 210 215 220

 Val Gln Pro Val Glu Gly Ala Phe Val Val Asn Leu Gly Asp His Gly

225 230 235 240
His Phe Leu Ser Asn Gly Arg Phe Lys Asn Ala Asp His Gln Ala Val
 245 250 255
Val Asn Ser Asn Tyr Ser Arg Leu Ser Ile Ala Thr Phe Gln Asn
 260 265 270